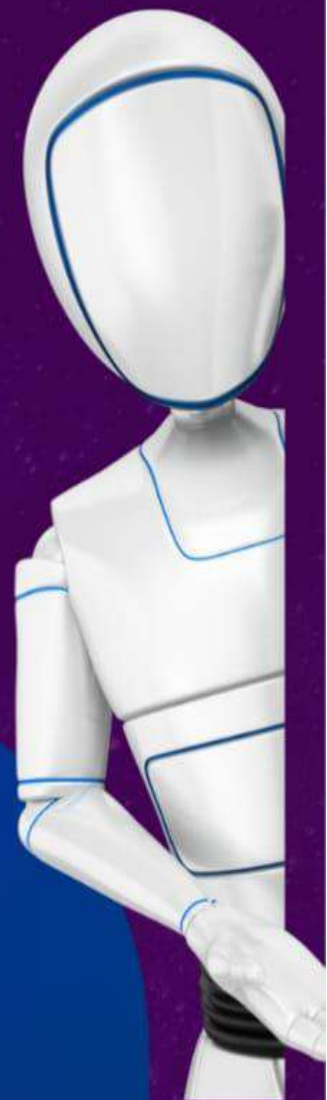


سلسلة مذكرات المتخصص



جروب

فريق أصدقاء الكمبيوتر



2nd Prep

Hanan Allam

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Second term

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unit four: python

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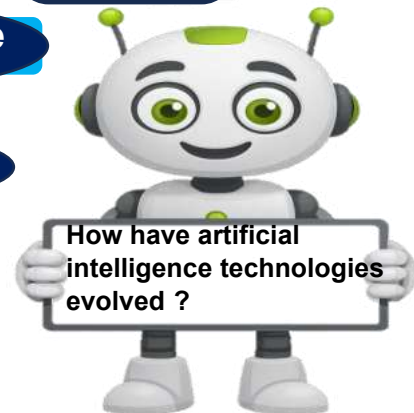
The Historical Development of Artificial Intelligence

Unti 3
lesson 1

Stages of the historical development of artificial intelligence

first The dream of developing machines that can think

- Before computers were invented, people dreamed of machines that could think and do tasks and work like humans. In ancient times, Humans invented "thinking machines"
- Ancient civilizations made efforts to build machines that could work on their own(Automation systems).



These efforts were not AI as we know it today. but ,
were found in myths, philosophy, early mechanics, and self-operating machines.

Second The Modern Era of Artificial Intelligence

The stages that paved the way for appearing the artificial intelligence:

A

1950

Alan Turing – The Father of Artificial Intelligence

- The British mathematician Alan Turing laid the foundations for modern artificial intelligence.
- He posed a pivotal question: "Can machines think"?
- He introduced a test known as the **Turing Test**:

The idea: Imagine you are chatting with someone via text message, and you don't know if it's a human or a computer program.

If you can't distinguish between the human and the machine, then the program has passed the Turing Test.

B

1956

The Dartmouth Conference: The Beginning of the Term

In the summer of 1956, a number of leading scientists met at Dartmouth College in the United States. **Their goal was very ambitious:**

- To create machines capable of learning and thinking like humans.
- During this conference** •The term "Artificial Intelligence" was officially coined for the first time.

C

1956 -1970

Years of Excitement and High Hopes

1-The early hopes

Following the Dartmouth Conference, scientists began creating the first artificial intelligence programs. These programs were very simple compared to what we see today, but they were astonishing at the time.

2-the Early Challenges: Scientists faced significant problems, the most important of which were:

- Slow computers. - Limited memory. A computer needed many hours to solve simple mathematical problems that a child could solve in a few minutes.

Examples of Early Programs:

General Problem Solver

A program that tries to solve general problems step-by-step.

Logic Theorist

A program that can solve logical mathematical problems

D

(1980 – 1970)

Expert Systems – Machines Learn from Experts:

1- Based on a smart idea

• Why not teach machines the expertise and knowledge of specialists?

In the 1970s, scientists changed their approach:

Instead of making machines think like humans, they were taught specialized knowledge taken from experts in specific fields.

MYCIN – The Robot Doctor:

MYCIN is one of the most popular expert systems.

-It's a program that helps doctors diagnose infectious diseases.

It works by asking the doctor or user questions such as:

-Does the patient have a fever? - What are the other symptom

After analyzing the answers, it suggests the appropriate treatment

What distinguishes MYCIN: - Its accuracy was very high, reaching a level that rivals that of expert human doctors .



E

(1990 – 1980)

The Winter of Artificial Intelligence (1980–1990) – When Dreams Faded:

1.The Great Challenges:

- In the 1980s, artificial intelligence faced a real crisis.
- The initial enthusiasm turned to disappointment.

2. Causes of the Crisis (Why Did It Happen?):

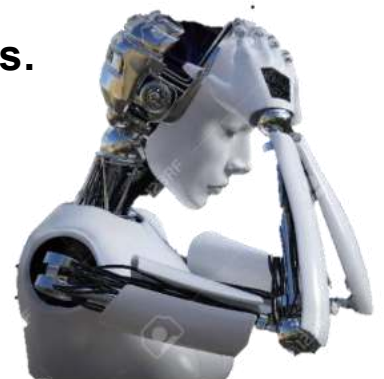
- **Overstated Promises:** Scientists promised more than the technology could achieve..
- **Technical Limitations:** Computers were slow.
- **Limited Memory**
- **High Cost:** Developing AI systems was very expensive.
- **Limited Results:** Programs operated only in narrow fields.

3. Lessons Learned:

This period wasn't entirely bad

4. Scientists learned that:

Artificial intelligence is more difficult than they thought Development requires patience and better technological advancements.



F positive message: Sometimes we need to face failure to learn and become stronger!

(2010 – 1990)

The Renaissance – A Resurgence of Hope

1. The Internet and Data Revolution:

-In the 1990s, a major development occurred with the advent of the internet. Scientists gained access to enormous amounts of data. This data helped advance artificial intelligence research.

2. Machine Learning – A New Way to Teach Machines:

- Instead of programming machines with knowledge, scientists decided to teach them how to learn from data by themselves.
- This is called "Machine Learning".

An example of machine learning

For teaching a computer to distinguish between pictures of cats and dogs:

- Instead of describing the cat's shape ("it has pointed ears and whiskers"),
- you feed the computer thousands of labeled images and let it discover the patterns itself .

Amazing Achievements:

- For the first time in history, a computer beat the world chess champion! It was a amazing event watched by millions around the world.

G The Modern Revolution–Deep Learning Changes Everything (2010-Now)

What is Deep Learning?

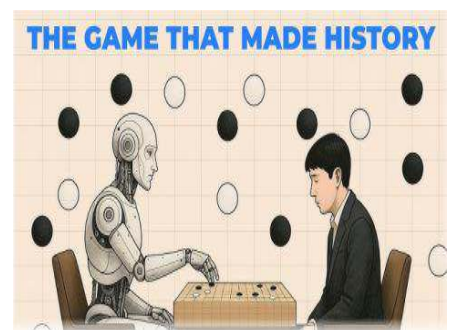
- It is an advanced type of Machine Learning that mimics the way the human brain works!
- It uses Artificial Neural Networks.

Example explain How It Works:

- Think of your brain as a network of interconnected neurons.
- **Each cell** : receives signals and sends out others.
- **Deep Learning mimics this process!**

Amazing Achievements:

- A computer won against the world champion in the Chinese game "AlphaGo" , this game much harder than chess!.



Put a check mark (✓) next to the correct statement, and a check mark (x) next to the incorrect statement.:

1. The concept of artificial intelligence is a very recent one, emerging in the last few years. ()
2. The concept of artificial intelligence faced many challenges in its early stages. ()
3. The Turing test is a method for determining whether a machine can successfully simulate human thought. ()
4. Machine learning is a branch of artificial intelligence that allows a computer to learn from experience. ()
5. Artificial intelligence is used only in games and entertainment. ()
6. Deep learning is an advanced type of machine learning. ()
7. Artificial intelligence will be an helpful tool in many future jobs. ()

Choose the correct answer from the following options:

1. What is the best description of artificial intelligence?

- A. Making machines faster and stronger.
- B. Making machines think and learn like humans.
- C. Making machines bigger.
- D. Making machines smaller.

2. Which scientist created a famous test to determine if a machine is intelligent?

- A. Isaac Newton
- B. Albert Einstein
- C. Alan Turing
- D. Al-Khwarizmi

3. Why is learning artificial intelligence important for your future?

- A. Because it will soon disappear.
- B. Because it will become an essential part of our jobs and daily lives.
- C. Because it is a difficult and complex subject only for customers.
- D. Because it is an entertainment tool.

4. A computer learning to play chess and beat the best players is an early example of:

- A. Machine learning
- B. The internet
- C. 3D printing
- D. Using office software

5. How can artificial intelligence help solve the problem of traffic congestion?

- A. By manufacturing more cars
- B. By analyzing data and organizing traffic flow
- C. By removing traffic lights,
- d) By disabling car movement.

6. The statement "Artificial intelligence is a powerful tool" means that:

- a) we should fear and avoid it
- b) we should understand its impact and direct it to serve humanity
- c) no one can control it
- d) its irresponsible use





How Do Machines Think and Change Our World?

Unit 3: lesson 2

- Smart devices and apps may automatically suggest songs or content. These capabilities are not magic, but rather a result of artificial intelligence.

• **Artificial intelligence enables machines to behave as if they are thinking and interacting with intelligence similar to that of humans.**

In your phone

- Voice assistants
- facial recognition
- text prediction.

In games

- Smart characters that interact and adapt with you

In the internet

- Smart search engines
- personalized content suggestions.

What is the artificial intelligent?

The ability of machines to "think", make decisions, and solve problems.

AI can be also defined as the ability of computer systems to simulate some human abilities, **such as:**

- Learning from data.
- Solving problems.
- Recognizing patterns in images and sounds.
- Making decisions.
- Understanding natural language.

Deeper Understanding of Artificial Intelligence:

Artificial intelligence is like building a "digital brain" for a machine. This brain lacks feelings or self-awareness.

It is characterized by its high capacity to process massive amounts of information very quickly.

It can detect patterns and relationships to make logical and accurate decisions.



Examples from your daily life of AI uses:

Video games

- Smart Competitors in video games.
- Personalized tips to improve your performance.
- Non-player characters use artificial intelligence to make complex decisions such as
 1. Choosing the best strategy to attack
 2. or escape, and learn from your playstyle to become



Voice assistants

Siri, Alexa, and Google Assistant use natural language processing technologies to understand your speech, convert it to text, and analyze the meaning to fulfill your request or answer your questions.



Comparison between Human Intelligence and Artificial Intelligence

Human Intelligence	Artificial Intelligence
Feelings and Awareness: - Humans feel complex emotions like joy, sadness, love, and empathy. - Humans also have self-awareness	Pure Data Processing: - AI does not feel emotions - It has no self-awareness - It only processes information and data
Creativity and Innovation: Humans can create new ideas and solve problems in untraditional ways	Super Speed and Accuracy: - AI processes trillions of data points in seconds - It executes complex tasks with high accuracy.
Deep Understanding and Context: Humans understand jokes, sarcasm, hidden meanings, and complex social situations.	Logic and Pure Data: Decisions are based on data and programmed rules, without emotions

Why is artificial intelligence important to us today?

Imagine having an AI assistant that can learn, think, and make decisions just like humans.

This is artificial intelligence (AI). It's all around us:

- When Google searches for your answer,
- When Facebook suggests a new product,
- When you and your friends play video games.



AI is a powerful force; it's not just a technology; it's a tool that can:

- Help us solve big problems,
- Make Our lives are easier, and it opens doors for us that we never imagined before!

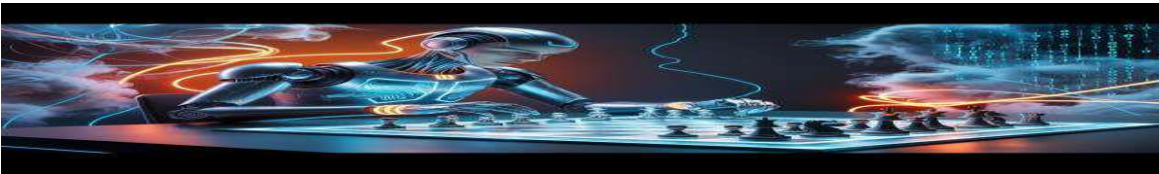
Artificial intelligence in our daily lives

Examples of AI in Our

In Your Phone

Siri, Google Assistant	The phone's camera automatically enhances photos	Applications that translate texts instantly
		

In games

Smart characters that interact and adapt with you	Tips designed to improve your performance
	

In entertainment

Watch IT : It suggests suitable films for you	Spotify : Discover songs you'll love
	

At home

•Smart vacuum cleaners	Smart devices that control lighting
	

2

School book exercises



Q1-Put a check mark (✓) next to the correct statement, and a check mark (×) next to the incorrect statement.:

- Artificial intelligence can sense human emotions ()
- Artificial intelligence relies solely on data processing without self-awareness ()
- Characters in video games can learn from the user's gameplay style. ()
- Human intelligence possesses creativity, while artificial intelligence imitates and does not innovate .. ()
- Phone cameras that automatically enhance photos use artificial intelligence. ()
- Smart search engines like Google do not rely on artificial intelligence. ()
- Artificial intelligence can understand sarcasm and emotions with the same accuracy as humans . ()
- Robots can be programmed to make decisions based on data. ()
- Smart home devices, such as smart vacuum cleaners, rely on artificial intelligence . ()

Q2: Choose the correct answer from the following options:

1. Artificial intelligence is:

- The machine's ability to feel.
- The machine's ability to "think" and make decisions.
- The human ability to control a computer.
- A program for displaying images.

2. An example of using artificial intelligence in mobile phones is:

- Writing messages only.
- Playing songs.
- Facial recognition.
- Manually opening the camera.
- An internet browser

3. Which of the following is a human intelligence ability and not an artificial one?.....

- a. Pattern recognition.
- b. Data processing speed.
- c. Creativity and innovation.
- d. Analyzing millions of data points.

4. Games use artificial intelligence to:.....

- a. Display backgrounds.
- b. Move the character static ally.
- c. Make characters adapt to the player's style.
- d. Increase the number of players.

5. An example of using artificial intelligence on the internet is:.....

- a. Changing the screen color.
- b. Suggesting appropriate content.
- c. Blocking the internet.
- d. Increasing browser speed.

6. Artificial intelligence is characterized by:.....

- a. Having feelings.
- B. Understands sarcasm
- C. Possesses self-awareness
- D. Processes data extremely fast

7. Siri is an example of:

- A. Image processing
- B. An AI-powered voice assistant
- C. A drawing program
- D .Internet browser

8. What can't AI do yet?

- A. Image analysis
- B. Learning from data
- C. Feeling sadness and joy
- D. Free artistic creativity

9 .Some of the capabilities of artificial intelligence include:

- A. Understanding deep social relationships.
- B. Making decisions based on data.
- C. Experiencing sadness and joy.
- D. Free artistic creativity.

10. Self-driving cars are an example of:

- A. Artificial intelligence in homes
- B. Artificial intelligence in education
- C. Artificial intelligence in transportation
- D. Artificial intelligence in medicine





Artificial intelligence is all around us. It's everywhere.

Unit 3
lesson 3

Ethical responsibility in the uses of artificial intelligence

- Artificial intelligence possesses immense power that can change the world for the better.
- It must be used wisely and ethically.
- **The goal** is to achieve benefit and safety for all.



Privacy and data

Your personal information must remain safe and protected; no one has the right to use your data without your consent

advice

Always read the privacy settings of any app or program you will use.



Justice and

Artificial intelligence systems must be designed in a fair and equitable way for all individuals, without discrimination.

Human supervision and control:

Artificial intelligence is a powerful and formidable tool, but it remains a tool, controlled and directed by humans. Humans set its goals and design its algorithms.

Critical decisions that affect individuals' lives (such as critical medical decisions or judicial rulings) should not be made solely by artificial intelligence; they should always be made by humans.

The reason: Because humans have: - Consciousness - Morality - The capacity for empathy - An understanding of complex social and cultural contexts
these qualities that artificial intelligence lacks.
conclusion: Humans establish the values and principles that AI technology adheres to.

- Important and critical decisions must always remain in human hands.

The problem of bias in artificial

Remember: Man is the leader who makes the final decision?

If an AI system is trained on incomplete, unfair, or biased data, it may "learn" this bias, and make unfair decisions

example

If a facial recognition system is trained on data that primarily contains faces of people from a particular race, it may have difficulty accurately recognizing faces of people from other races.

How can artificial intelligence technology be used responsibly?

Think critically: Don't automatically trust everything you see from artificial intelligence.

Verify information: Learn how to ensure the accuracy of information.

Artificial intelligence is not something to be afraid of; rather, it is a great force that can improve the world if properly directed.

3 School book exercise



Q1: Put a mark (✓) next to the correct statement, and a mark (X) next to the incorrect statement:

1. Artificial intelligence should be designed to be fair and equitable for everyone. ()
2. No one has the right to use your personal data without your agreement . ()
3. Artificial intelligence can make critical decisions better than humans. ()
4. Humans are the ultimate decision-makers because they possess ethics and awareness. ()
5. Bias in artificial intelligence can occur due to incomplete or unfair data. ()
6. It is safe to trust all results from artificial intelligence without verifying them. ()
7. Using artificial intelligence to improve the lives of others is a responsible practice ()
8. Facial recognition is not affected by the quality of the data used in training. ()
9. Part of the role of an intelligent user is to think critically and verify information. ()
10. The proposed student project encourages finding solutions using artificial intelligence to real-world problems. ()

Q2: Choose the correct answer from the

1- What is meant by fairness in artificial intelligence systems?

- A. Designing systems that operate faster.
- B. Designing systems that operate without human intervention.
- C. Designing fair and equitable systems for all individuals.
- D. Designing systems that monitor all data.

2. Examples of privacy protection include:

- A. Sharing your data with any application without review.
- B. Reading privacy settings before using a new application.
- C. Posting all your information online.
- D. Giving your password to a friend.

3. Who makes critical decisions in AI-based systems?

- | | |
|--------------|---------------------|
| A. AI alone. | B. Voice assistant. |
| C. Human. | D. Robots. |

4 Why should humans make important decisions?

- A. Because AI is slower.
- B. Because humans possess awareness, ethics, and empathy.
- C. Because humans don't make mistakes.
- D. Because AI cannot analyze data.

5. When does bias occur in AI?

- A. When data is diverse.
- B. When data is scarce or unfair.
- C. When data is abundant.
- D. When data is up-to-date

6 The result of training a facial recognition system on data of people of one race is that:.....

- A. It works efficiently for everyone.
- B. It becomes faster.
- C. It may fail to recognize other races.
- D. It improves in translation.

7- One of the roles of an intelligent user when dealing with artificial intelligence is

- A. Believing in everything that appears.
- B. Neglecting to verify information.
- C. Thinking critically and verifying information.
- D. Using technology only for play.

8- Which of the following is an example of responsible use of artificial intelligence?

- A. Using it to harm others.
- B. Using it to improve people's lives.
- C. Using it to spread rumors.
- D. Using it without reviewing the data.

9- What element does artificial intelligence lack that humans possess?.....

- A. The ability to store data.
- B. The ability to learn.
- C. The ability to feel and understand values.
- D. The ability to analyze numbers.

10- The goal of the "Little AI Innovator" project is:

- A. To design games only.
- b) Thinking up AI-powered solutions for simple problems
- c) Writing complex code
- d) Using AI in everything without any controls



The artificial neuron

Unit 3 lesson 4

First

What is the artificial neuron?

- An artificial neuron is a small unit within a computer.
- Its function is to mimic the way humans think.
- It resembles the neurons found in the human brain.

Each artificial neuron:

- Receives information from other neurons.
- Processes this information.
- Sends signals to other neurons.

Through this interconnection:

- the mind can understand and perceive.
- Make decisions and act.

Scientists have designed similar neurons within computers to help them think and make decisions.



second

Components of the artificial neuron:

The artificial neuron consists of 5 main

1 Inputs:

This is the information that enters the cell (such as an image, sound, or number).

2 weights

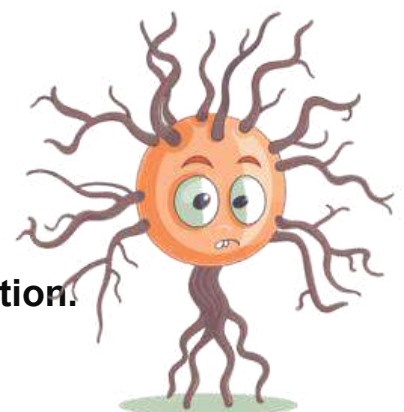
These are numbers that help the cell determine the

3 (Bias)

A number is added to the total to adjust the cell's operation.

Example of Bias

Imagine a student needs 50 points to pass but was sick during the exam. The teacher gives them extra points as a help. These extra points are like bias; they are added to the score to help the artificial neuron network reach the correct decision.





But what is the benefit of bias?

- It makes the artificial neuron more flexible.
- It allows the cell to produce results even when the input is zero.
- It is like "personal bias" that may influence our decisions as humans.



4 Activation function

The activation function is a crucial component of an artificial neuron

Its main function :is to make the final decision:

(Should the cell send a signal? Or remain silent?)

This decision depends on the results of calculations within the cell:

(Inputs × Weights + Bias).



The activation function is like a switch: (It either turns the cell on or off).

Without the activation function:

- The cell doesn't know how to react to the calculations.
- It cannot make any decisions.

Name	simplified function	practical example.
Threshold	What is it? It's a very simple function. It tells the cell: If the value is greater than a certain number (for example, 0.5), the result is 1. If it is less than or equal to the value, the result is =	Imagine the exam is out of 100 points, and the passing grade is 50. If you get 60, you pass; if you get 40, you fail. (Give yes or no)
Sigmoid	This function does not just give "yes or no", but also gives a ratio or probability between 0 and .1	The computer analyzes an image and says: "The probability that this is a cat is 0.85," meaning an 85% chance that it is a cat. If the percentage is high, we trust the decision. (Gives a percentage or probability)
ReLU	What is it? It gives the same value if it's positive (greater than zero), but if it's	The microphone does not record weak sounds. Loud sounds are recorded; very weak sounds are ignored. (Only positive values are considered)
positive	Negative or zero gives zero	(Positive values only)

4 The artificial neuron Outputs

Example: Dear student: Today we will learn how your grades in school subjects (science, mathematics, computer science) are calculated using a simple artificial neural cell, like those found in artificial intelligence!

input	Weights	Bias	Calculation method	Activation Function
These are your grades in each subject (out of 10, for example): Science: Your grade Mathematics: Your grade Computer Science: Your grade	Each subject has a different level of importance . For example: Science has a weight of 0.4 Mathematics has a weight of 0.3 Computer Science has a weight of 0.3	A fixed number (such as `1` is added to improve the result). For example, attendance during studies or coursework.	We multiply each grade by its weight, then add the result along with the bias: Score = (Science (0.4 x) + Math x (0.3(Computer (0.3 x 1)	To determine whether the student is "weak" or "excellent!", for example: If the result is greater than 5, "Excellent!" If it is less than 5, "Continue studying"!

Remember: AI learns just like you, so the harder you work,

Example: If your grades were:

Science: 8 - Math: 7 - Computer Science: 6

The calculation:

$(0.4 \times 0.8) + (0.3 \times 0.7) + (0.3 \times 0.6) + 1 = (3.2 + 2.1 + 1.8) + \text{bias } 1 = 8.1$

The result: (8.1) . Excellent



4 School book exercise

Put a check mark (✓) next to the correct statement, and a check mark (X) next to the incorrect statement:

1. An artificial neuron attempts to mimic the function of neurons in the human brain. ()
2. Weights within a neuron do not affect the final decision. ()
3. Bias helps the neuron produce results even in the absence of input. ()
4. The activation function is responsible for executing the neuron's final decision. ()
5. The Threshold function only gives values between 0 and 1. ()
6. The Sigmoid function is used to give a probability or ratio. ()
7. Inputs can be images, sounds, or numbers. ()
8. Without the activation function, the neuron would not be able to make a decision. ()
9. Weights are always constant values that do not change. ()
10. Bias plays no role in modifying the neuron's performance. ()

Q2: Choose the correct answer from the following options:

1-What is an artificial neuron?.....

- A. A program for running games
- B. A unit that attempts to mimic human thinking
- C. Part of a computer's memory
- D. A real biological cell

2. What is the function of inputs in an artificial neuron?:.....

- A. Storing results
- B. Sending decisions
- C. Receiving information
- D. Deleting data

3. Weights are used for?.....

- A. Decorating data
- B. Determining the importance of each piece of information
- C. Storing sound
- D. Activating the activation function

4. Bias is similar to?.....

- A. Deleting a score
- B. Increasing a small number to help the cell
- C. Doubling data
- D. Reducing weights

5. One of the functions of bias is?:

- A. Reducing the cell's accuracy
- B. Preventing the cell from functioning
- C. Making the cell more flexible
- D. Eliminating the use of inputs

6. What is the function of the activation function?.....

- A. Managing memory
- B. Making the final decision
- C. Calculating weights
- D. Data Storage

7- The Threshold function acts as:.....

- A. Probability.
- B. An on/off switch that depends on a certain threshold.
- C. A color scale.
- D. A sound system.

8- The Sigmoid function gives

- A. A negative number.
- B. A number between 0 and 1 (probability).
- C. A random number.
- D. A number greater than 10.

9- Which part of the cell helps it make a decision even when the input is zero?

- A. Inputs.
- B. Weights.
- C. Bias.
- D. Input function.

10- In a neuron: What happens after calculating (inputs × weights + bias)?

- A. The data is cleared.
- B. It is sent directly to the user.
- C. It is passed to the activation function.
- D. The cell stops working.



The role of artificial neuron in artificial intelligence

Unit 3 Lesson 5

The artificial neural cell is the foundation for building what are known as artificial neural networks, which are used in :

Weather or price forecasting

Talking to a human (like smart assistants).

Translation between languages

Image recognition

1 How do we build the artificial neuron ?

To build an artificial neuron network, we need to:

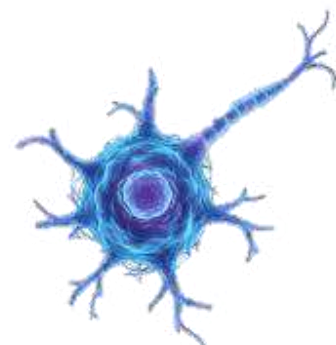
- Determine the type of data to be input (e.g., numbers or images) assign a weight to the input.
- Multiply the input by its weight.
- Pass the result to the activation function.



2 How does the artificial neuron work?

Imagine you want to know if an image contains a cat: -

- The image is entered as input. The cell analyzes the image using weights.
- The activation function decides: Is this a cat? Yes or no? - The result is sent to other cells or given to you directly.



3 How dose the artificial neuron function in intelligence?

When we connect thousands of artificial neurons together, we get a powerful neural network that can:

- Learn from experience.
- Improve itself over time.
- Solve complex problems such as driving cars or diagnosing diseases.

4 Real-life applications of artificial neuron

- Smart assistants such as Siri and Alexa
- Smart cameras that recognize faces
- Self-driving cars
- Real-time translation between languages
- Diagnostic tools in hospitals
- Movie recommendations on platforms like Netflix and YouTube



5 School book exercises

Q1: Put a mark (✓) next to the correct statement, and a mark (×) next to the incorrect statement:

1. An artificial neuron is the foundation upon which the structure of artificial neural networks is built ()
2. Artificial neurons are used only in language translation and weather forecasting, not in image recognition ()
3. The type of data to be input (e.g., numbers or images) must be determined as a first and necessary step in building an artificial neuron. ()
4. The step immediately preceding passing the output to the activation function is assigning a weight to each input . ()
5. The ultimate goal of a neuron is to obtain the final output, which is a decision or prediction . ()
6. The activation function is what analyzes the image using the weights in the cat recognition example . ()
7. One real-world application of artificial neurons is their use in diagnosing diseases in hospitals . ()
8. When thousands of neurons are connected together, the network loses its ability to learn from experience and improve itself over time . ()
9. Self-driving cars are not among the complex problems that powerful neural networks can solve . ()
10. Smart cameras that recognize faces are an example of a real-life application of artificial neural technology . ()

Q2: Choose the correct answer from the following options:

1. What is the basis for building what is known as artificial neuron networks?

- | | |
|----------------------------|-------------------------------------|
| A. Complex algorithm. | B. Artificial neuron. |
| C. Intelligent assistants. | D. Real-time translation functions. |

2. What is the step after determining the data type and assigning a weight to each input in building an artificial neuron?

- | | |
|--|---|
| A. Obtaining the final output. | B. Passing the output to the activation function. |
| C. Sum the inputs after multiplying them by their weights. | |
| D. Analyzing the image using the weights. | |

3. What is the primary role of the activation function in an artificial neuron 's operation scenario?

- A. Determining the weights for each input.
- B. Sum the weighted inputs.
- C. Reporting the final decision (yes/no).
- D. Inputting the image as an input.

4. When we connect thousands of artificial neurons together, we obtain a powerful neural network capable of solving complex problems such as:

- A. Writing simple programs.
- B. Storing data.
- C. Driving cars or diagnosing diseases.
- D. Analyzing handwritten texts only.

5. One real-life application of the aforementioned of artificial neuron, related to content suggestion, is:

- A. Intelligent assistants such as Siri.
- B. Cameras that recognize faces
- C. Suggesting movies on platforms like Netflix
- D. Self-driving cars

6. Artificial neurons are among the technologies used in:

- A. Analyzing fixed product prices
- B. Manually setting product prices
- C. Weather or price prediction
- D. Displaying a list of all historical prices

7. What ability does a powerful neural network gain over time as a result of learning from experience?

- A. Maintaining input weights and not changing them
- B. Automatically increasing the number of cells
- C. Improving itself over time
- D. Not needing an activation function

8. If a neuron is analyzing an image (for example, a cat), what input goes into the cell?

- A. The decision (yes/no)
- B. The final output
- C. The image
- D. The activation function

9. Which of the following applications is an example of an intelligent assistant that relies on artificial neurons?

- A. Smart air conditioners
- B. Siri and Alexa
- C. Computer operating systems
- D. Cameras

10- After the activation function determines the result (e.g., Is this a cat? Yes or No?), what is the next step?

- a. Re-specify the data type. b. Sum the weighted inputs.
- c. Assign a weight to each input.
- d. Send the result to other cells or provide the answer directly.



Introduction to Data Analysis in Python

Unit 3
lesson 6



The concept of data analysis and its importance

Data analysis is the process of examining, cleaning, and transforming data to extract useful information and make fact-based decisions . .

1 Why do we use Python to analyze data ?

Python is considered one of the best programming languages for data analysis because of:

- Ease of learning and use: Its simple syntax makes it suitable for beginners.
- Powerful libraries such as:
 - Pandas for data manipulation.
 - NumPy for scientific calculations.
 - Seaborn and Matplotlib for graph visualization.
- A large support community with numerous learning resources.
- Its compatibility with artificial intelligence (AI) and machine learning.)



Basic concepts in data analysis

The arithmetic mean : is the sum of the values divided by the number of values.

Example in Python:

```
import numpy as np
data = [10, 20, 30, 40, 50]
mean = np.mean(data)
print("the mean:", mean)#30.0: the result
```

A simplified explanation of the code

(import numpy as np) its Function:

To call the NumPy library used for calculations process in Python.

*`np :as` is an abbreviation of the library name so we can use `np` instead of writing the full `numpy` file.

Example without an abbreviation:

```
import numpy
mean = numpy.mean(data) # longer in typing
data = [10, 20, 30, 40, 50]
```

Function: Create a list containing the numbers whose average we want to calculate.

• **Note:** The list can contain any numbers (they do not need to be sorted).

Another example :

np. mean: A built-in function in NumPy for calculating the arithmetic mean.

How does the mean work?

• Mean = (sum of numbers) ÷ (number of numbers)

```
data = [5, 15, 25, 35, 45]
mean = np.mean(data)
```

here $(10 + 20 + 30 + 40 + 50) / 5 = 150 / 5 = 30.0$

Manual example without NumPy

```
sum_data = sum(data) # 150
count = len(data) # 5
mean = sum_data / count # 30.0
print("the mean:", mean)
```

Function: Displays the result on the screen.

• **Output:** the mean: 30.0

Note: The result will be a floating decimal (float) even if it is correct.

Min & Max values:-

Maximum value:(Max) :- **The largest** value in the data set

Minest value : (Min) :- **The smallest** value in the data set



```
maximum = np.max(data)
minimum = np.min(data)
print(« the largest value:»,maximum) # 50
print(« the smallest value:»,minimum) # 10
```


2 Why do we use Python to analyze data?

- **Numerical Data**
- **Decimal** numbers such as weights and prices. - **Integers** such as number of people and the number of products.
- **Text Data**
 - Text such as customer comments and articles.
 - Can be analyzed using Natural Language Processing (NLP).
- **DateTime Data**
 - Dates such as purchase dates and event dates. - Can be analyzed using `pandas.to_datetime()`.

Code explanation:

Importing the Pandas Library

```
import pandas as pd
```

```
import pandas as pd
dates=["2023-01-01", "2023-01-02", "2023-01-03"]
date_series = pd.to_datetime(dates)
print(date_series)
```

- We use `'import pandas as pd'` to import the library and name it `'pd'` for ease of writing.
- Creating a list containing dates as text strings.

```
dates = ["2023-01-01", "2023-01-02", "2023-01-03"]
```

Here we define a variable (dates) containing 3 dates in the format YYYY-MM-DD year-month-day.

Converting dates to Date Time objects `date_series = pd.to_datetime(dates)`

We use the `'pd.to_datetime'` function to convert the list of dates into a DateTime Series. The result will be a DatetimeIndex **object that can be operated on by date**, such as: - Extracting the day, month, and year. - Calculating time differences. - Filtering by date.

Printing the result. `print(date_series)`

The output will be:

```
DatetimeIndex(['2023-01-01', '2023-01-02', '2023-01-03'], dtype='datetime64[ns]', freq=None)
```

This means that the data is now ready to be handled as dates, not texts.

Why we use `pd.to_datetime()`?

Enabling time operations such as:

- Calculating the period between two dates
- Extracting date components (day, month, year)
- Grouping by date, e.g., total monthly sales
- Date validation: Rejects invalid dates such as "1-13-20230".

6 School book exercises

Q1: Put a mark (✓) next to the correct statement, and a mark (×) next to the incorrect statement:

- 1- Data analysis helps in making fact-based decisions ()
- 2- Python does not have libraries to support data analysis . ()
- 3-The Pandas library is used to clean and manipulate data . ()
- 4- The np.mean() function is used to find the smallest value in a list . ()
- 5- The arithmetic mean can be calculated manually without `NumPy` ()
- 6- Text data can never be parsed . ()
- 7-` pd.to\_datetime()` can reject invalid dates such as "01-13-2023" ()
- 8- The maximum value (Max) is the smallest value in the data . ()
- 9- The arithmetic mean produces a decimal number even if the results are integers . ()
- 10-Python can be used to parse date and time data . ()

Q2: Choose the correct answer from the following options:

1.What is the definition of data analysis?.....

- | | |
|-----------------------------|-----------------------|
| A. Charting. | B. Text manipulation. |
| C. Scientific calculations. | D. Image analysis. |

2- Why is Python suitable for data analysis?.....

- A. Because it is difficult to learn.
- B. Because it doesn't have libraries.
- C. Because it has powerful libraries like Pandas and NumPy.
- D. Because it only works on phones.

3- What is the function of the NumPy library?.....

- | | |
|-----------------------------|-----------------------|
| A. Charting. | B. Text manipulation. |
| C. Scientific calculations. | D. Image analysis. |

4- The np.mean() function is used to calculate

- | | |
|-------------------------|-------------------------|
| A. The largest number. | B. The smallest number. |
| C. The arithmetic mean. | D. Adding two lists. |

5- In the code `import NumPy as np`, what does `as np` mean?.....

- A. Deleting the library.
- B. Changing the Python language.
- C. Shorthand for the library name for easier use.
- D. Running the library automatically.

6- The maximum value (Max) is

- A. The smallest value in the data.
- B. The largest value in the data.
- C. Average of values
- D. Product of values

7- What type of data can be analyzed using NLP?

- A-Numerical data
- B- Images
- C. Text
- D. Dates only

8- What is the purpose of `pd.to\_datetime`?

- A- Converting text to numbers.
- B- Converting text dates to a time format.
- C. Deleting dates.
- D. Automatically sorting data.

9- What type of data is in the list?.....

```
data = [10, 20, 30, 40, 50 ]
```

- A-Text data. .
- B- Historical data.
- C. Numerical data.
- D. Audio data.

10- Which library is used for graph visualizations in Python?.....

- A- Pandas.
- B- NumPy
- C. Matplotlib
- D. datetime



Answers 's keys to the questions in Unit 3

Lesson one

Choose				True or false			
1	Making machines think and learn like humans	6	We must understand its impact and direct it to serve humanity.	1	X	6	✓
2	Alan Turing	7		2	✓	7	✓
3	Because it will become an essential part of our jobs and daily lives	8		3	✓	8	
4	Machine learning	9		4	✓	9	
5	By analyzing data and regulating traffic flow	10		5	X	10	

Lesson 2

Choose				True or false			
1	The machine's ability to "think" and make decisions	6	Processes data extremely fast	1	X	6	X
2	Facial recognition	7	An AI-powered voice assistant	2	✓	7	X
3	Creativity and innovation	8	Feeling sadness and joy	3	✓	8	✓
4	Character adaptation to the player's style	9	Making decisions based on data.	4	X	9	✓
5	Relevant content suggestion	10	AI in transportation	5	✓	10	

Lesson 3

choose				True or false			
1	Designing fair and equitable systems for all individuals	6	It may fail to recognize other races.	1	✓	6	X
2	Facial recognition.	7	Critical thinking and fact-checking	2	✓	7	✓
3	Humans	8	Using it to spread rumors	3	X	8	X
4	.Because humans possess awareness, ethics, and empathy.	9	The ability to feel and understand values	4	✓	9	✓
5	When data is scarce or unfair	10	Thinking of AI-powered solutions to simple problems	5	✓	10	✓

Lesson 4

Choose				True or false			
1	A unit that attempts to mimic human thought processes:	6	Final decision-making	1	√	6	√
2	Receiving information	7	On/Off switch based on a specific threshold	2	X	7	√
3	Determining the importance of each piece of information	8	Number between 0 and 1 (probability)	3	√	8	√
4	Increasing a small number to assist the cell	9	Bias	4	√	9	X
5	Makes the cell more flexible	10	Passed to the activation function	5	X	10	X

Lesson 5

Choose				True or false			
1	Artificial neuron	6	Weather or price forecasting	1	√	6	X
2	Add Input after multiplying them by their weights	7	Improves itself over time	2	X	7	√
3	Final decision report (yes/no)	8	image	3	√	8	X
4	.Driving cars or diagnosing diseases	9	Siri and Alexa	4	X	9	X
5	Suggesting movies on platforms like Netflix	10	Send the result to other cells or give you the answer directly	5	√	10	√

Lesson 6

Choose				True or false			
1	arithmetic calculations	6	Largest value in data	1	√	6	X
2	Pandas and NumPy	7	Dates only	2	X	7	√
3	arithmetic calculations	8	Convert text dates to a time format	3	√	8	X
4	arithmetic mean .	9	Numerical data	4	X	9	√
5	Abbreviated name of the library for ease of use	10	Matplotlib	5	√	10	√



practical application of data analysis from an Excel file Lives

Unit 4 lesson 1

Operating environment requirements:

The Library	The recommend libraries for (python packages) is:	Library function
pandas	pip install pandas	For analyzing data and reading Excel files.
matplotlib	pip install matplotlib	For creating charts and graphs.

An Excel file named grades.xlsx must be located in the same folder as the program for the code to work.

Look at student the data table on page 47.

File contents			
English	Science	Math	Name
15	11	12	Ali
12	14	14	Haled
13	15	13	mohammed
14	12	11	sabah
15	13	10	mustafa
12	13	15	yousef

1 Loading and Displaying Data:

```
import pandas as pd
```

```
df = pd.read_excel('grades.xlsx') # Load the file
```

```
print(df.head()) # Display the first 5 rows
```

The code explaining

Import the pandas library

This calls the library **pandas** to deal with the date, tables.

Read the excel file

```
df = pd.read_excel('grades.xlsx')
```

This code opens the Excel file and stores it in a variable called `df`.

Display the first 5 rows

`Print(df.head())` : This code prints only the first 5 rows to ensure the data format is correct.so we understand how is reading an excel file data and display some basic information about it .



Analyzing the basic data

```
grades = df[['Math', 'Science', 'English']]
print ("Average")
print(grades.mean().to_dict()) average grades for each subject.
print ("Maximum value")
print(grades.max().to_dict()) The greatest dgrade for each subject.
print ("Number of successful students")

print((grades > 13).sum().to_dict()) The number of the success student for each subject
```

The code	Its meaning
<code>grades = df[['Math', 'Science', 'English']]</code>	We selected only the grades for three subjects from the table (df): Mathematics, Science, and English, and placed them in a variable named <code>.grades</code>
<code>Print("Average")</code> <code>print(grades.mean().to_dict())</code>	We print the word "Average" and then calculate the average grade for each subject (i.e., the sum of the students' grades ÷ their number), and convert it to an easy-to-read format (a dictionary).
<code>print ("Maximum value")</code> <code>print(grades.max().to_dict())</code>	We print "Maximum value" and then display the highest grade any student achieved in each subject.
<code>Print("Number of successful students")</code> <code>Print((grades > 13).sum().to_dict())</code>	We print the number of students who passed each subject, then calculate the number of students who scored above 13 in each subject (i.e., passed), and display the number.
In short: This code performs a statistical analysis of the data in the table and displays: - The average grade for each subject. - The highest grade in each subject. -The number of students who passed each subject.	

Representing the data graphically

The code	Its meaning
<code>import matplotlib.pyplot as plt</code> <code>df.mean().plot(kind='bar')</code> #Graphing material averages <code>plt.show()</code> # display the graph	The code draws a bar graph of the average grades for the subjects.
<code>import matplotlib.pyplot as plt</code>	This line means that we are using a library called <code>matplotlib</code> , which helps us draw graphs.
<code>"as plt"</code>	Using the abbreviated name <code>plt</code> instead of the long name makes writing easier and saves time.
<code>grades.mean().plot(kind='pie')</code>	Here we tell the program: Take the average grade for each subject using <code>`grades.Mean()`</code> , then plot it as a circle using <code>plot(kind='pie')</code> <code>plt.show()</code>

Finally: We ask the program to display the graph.

The result: A graph appears with columns, each column representing the average grade for a subject. This makes it easy for us to compare grades quickly and clearly.

Analysis of basic data

It calculates the relationship between subjects in a spreadsheet.

What does this mean? It means: Does one subject affect another? For example, if a student excels in math, will they likely also excel in science?

What does the code result in? It will display numbers between -1 and 1.

If it's close to 1, the relationship is strong and positive (both subjects rise together).

If it's close to 0, there's no clear relationship.

If it's close to -1, the relationship is inverse (if one increases, the other decreases)..

1

School book exercise

Choose the correct answer :-

1. What is the primary function of the pandas library?.....

- A. Drawing graphs. B. Playing audio files.
C. Analyzing data and reading Excel files. D. Creating websites.

2. Which library is responsible for creating graphs in Python?.....

- A. NumPy. B. pandas. C. tkinter. D. matplotlib.

3. What command is used to load an Excel file?.....

- A. pd.load_file()- B. pd.read_excel()- C. pd.open()- D. df.read()-

4. What does the df.head() command do?.....

- A. Deletes the first 5 rows. B. Displays the first 5 rows.
C. Displays the last 5 rows. D. Displays the number of columns.

5. What type of graph is produced by grades. Mean().plot(kind='bar')?

- A. Pie chart. B. Dot plot.
C. Line drawing. D. Bar drawing.

6- What does the following code do: grades.mean()?

- A. Calculate the highest grade. B. Calculate the lowest grade.
C. Calculate the average grade for each subject. D. Delete the columns.

7- What is the function of the following code: grades.max()

- A. Find the lowest grade. B. Find the highest grade.
C. Calculate the total grades. D. Count the number of students.

8- What is the function of the following code: grades > 13).sum()?

- A. Calculate the students' grades. B. Count the number of students above 13.
C. Compare students to each other. D. Reorder the grades.

9- What does: .df.corr() mean?

- A. Show the number of rows. B. Calculate the correlation between subjects.
C. Download the data. D. Calculate the average.

10- Which of the following is used to display the graph?

- A. plt.show()- B. plt.start()- C. plt.run()- d. -()plt.open



Put a check mark (✓) next to the correct statement, and a check mark (X) next to the incorrect statement.:

1. The pandas library is used to read Excel files and analyze data. ()
2. The `head()` function displays all the data in the table. ()
3. The matplotlib library can create bar, pie, and line graphs. ()
4. The `grades.max()` command calculates the average student grades. ()
5. `df.corr()` helps determine the relationship between different subjects. ()
6. `plt.show()` does not display the graph. ()
7. Using `(grades > 13)` gives true or false results for each student. ()
8. The `grades.mean()` code returns the highest grade, not the average. ()
9. The `grades.xlsx` file must be located in the same folder as your Python program for the code to function correctly. ()
10. Pandas can be used to create graphs without needing a separate library. matplotlib ()

conditional statements in Python Applications

Unit 4 lesson 2



The Concept of Conditional Statements:

In Python, conditional statements are used to make logical decisions based on the fulfillment of a specific condition.

These statements tell the program to execute a specific part of the code only if the condition is true.

what is the Conditional Statement:

A conditional statement is a programming construct that allows a program to choose between several paths of execution based on specified conditions.

General Syntax for a Conditional Statement:

```
if condition: ...If the condition is true
    execute this code .....
else:
    Otherwise execute this code instead .....
```

Types of Conditional Statements in Python:

1- If statement :

Example

```
age = 18
if age >= 18
Print("you can Enter")
```

2. If.....else statement:

Example

```
Age =16
If age >=18
Print("you can Enter")
Else:
Print("you could not Enter")
```

Practical example

3-if ...elif ...else statement:

example

```
mark = 85
if mark >= 90:
    print("Excellent")
elif mark >= 75:
    print("Very Good")
elif mark >= 60:
    print("Good")
else:
    print("Failed")
```

```
number = int(input("Enter a number: "))
if number > 0:
    print("The number is positive")
elif number < 0:
    print("The number is negative")
else:
    print("The number is zero")
```



2 School book exercise

Q2: Choose the correct answer from the following options:

1- What is the purpose of conditional statements in Python?.....

- A. To simply repeat code.
- B. To execute specific code when a condition is true.
- C. To define functions.
- D. To create variables.

2- What is the correct syntax for writing an if statement:.....

- A. if: condition
- B. if condition:
- C. condition if:
- D. if (condition) then

3- What happens if the condition in an if statement is false?.....

- A. The if code is executed.
- B. The program stops completely.
- C. The if statement is ignored and moves on to the next step.
- D. A programming error occurs.

4- The else statement is used when...

- A. The condition is always true.
- B. The condition is not present.
- C. We want to execute alternative code when the condition is not true.
- D. We want to define a variable.

5- Which of the following is a correct example of an if...else statement?.....

- | | |
|---------------------------------|----------------------------------|
| A. if x > 10 else: | B. if x > 10: else x: |
| C. if x > 10: print("OK") else: | D. print("NO"). if x > 10: else: |

6- What does the word elif mean?.....

- | | |
|--|--------------------------|
| A. End of program | B. Loop |
| C. Additional branch between if and else | D. A predefined function |

7- Which statement is used to test several consecutive conditions?.....

- | | |
|---------------------|--------------|
| A. if only | B. else only |
| C. if...elif...else | D. print |

8- What happens if the first condition in an if...elif...else sequence is true?.....

- | | |
|---|--|
| A. All conditions are executed | B. Only the elif condition is executed |
| C. The remaining conditions are ignored | D. A warning appears |

9- Which of the following is a true condition in Python?.....

- | | |
|--------------|---------------|
| A. if x = -5 | B. if x == 5 |
| C. if x => 5 | D. if x <=< 5 |

10- When writing:.....

age = 18

if age >= 18:

print(" You are allowed ")

What is the result?.....

- | | |
|---------------------------------------|-----------------------------------|
| A. Nothing will be printed. | B. An error will appear. |
| C. "You are allowed" will be printed. | D. "Not allowed" will be printed. |

Put a check mark (✓) next to the correct statement, and a check mark (X) next to the incorrect statement.:

1. An if statement is used to make a decision based on a condition. ()
2. An else statement can be written without an if statement before it. ()
3. More than one `elif` can be used in the same conditional statement. ()
4. A condition in Python must end with a semicolon (;). ()
5. An if statement can execute more than one line of code. ()
6. An `elif` statement is short for the `else` if statement. ()
7. The condition inside an `if` statement must be a calculation only. ()
8. A conditional statement can contain an `if` statement without `else`. ()
9. The code inside an `if` statement must be indented by only one space. ()
10. `if...elif...else` helps the program choose only one path to execute. ()

loops and functions

Unit 4 lesson 3



First: Loops : Loops help you execute a specific command multiple times without having to rewrite it over and over again

1-For loop :

It Use for :- Looping for a known number of iterations: We use this when we know beforehand how many times we want to repeat the code

General syntax:

Example

```
for i in range(5):    repeat "welcome" 5 times
Print("welcome")
```

Note: This means from 0 to 4 (5 times), and each command under `for` is executed in each repetition.

2-While loop :

It sue for a conditional repetition: It continues to run as long as the condition is true and stops as soon as it becomes false.

General syntax:

```
While condition :
```

The code that repeats as long as the condition is true #

(There must be something to change the condition, otherwise it will continue forever!)

Example

```
X=0
While x<3:    # if x is less than 3
Print("I am learning ")    # it will printed 3 times
X=x+1    # x will increase 1 each cycle
```


Notes: The loop continues as long as the condition ($x < 3$) is true.
Beware of infinite loops; if you forget to increment x , they will continue forever!

Example: Print numbers from 1 to 5 to:

```
for num in range(1, 6): # من 1 إلى 5
    print(num)
```

تعني من 1 إلى 5 (6 غير مشمولة) range(1, 6)

Notes: Adding the list numbers: n takes the value of each item in the list in order

```
numbers = [10, 20, 30]
sum = 0
for n in numbers: # لكل رقم في القائمة
    sum += n # أضفه إلى المجموع
print("المجموع =", sum) # الناتج: 60
```

Remember: Adding list numbers: - Use `for` when you know the number of times. - Use `while` when the repetition depends on a condition.

What is the function ?

Its function: To perform a specific task (such as calculating the sum of two numbers, printing a message, etc.)

Its benefit: It makes the code more organized, easier to understand, and easier to modify.

Notes:

Imagine a function as a small machine that performs a specific task when instructed to do so. Instead of writing the same code repeatedly, we write it

How to create a function:

```
def greet( ): # We use def to create a function.
    print("Hello! I am a beginner function") # The code inside the function
```

Note: The function does not work until we call it!

Code Explanation:

- `def` is short for define (definition), we use it to create a function.
- `greet()` is the function name (you can choose any name).
- `:` We put it after the function name.
- Indentation (`indent`): Necessary for all code inside the function

How to Call the Function:

`greet()` # Call the function to execute the code inside it

Result: Hello! I am a beginner function

with Parameters (Input):

```
def add(a, b):      # a and b are the function inputs
result = a + b
print(f"The sum is: {result}")
add(3, 5)          # Pass the numbers 3 and 5 to the function
```

Result:

The sum is: 8

Explanation of Parameters:

a, b: Values we pass to the function to work on them.

- {result}: We use **f-string** to display the result.

Function that Returns a Result(Return):

```
def multiply(x, y):
return x * y          # Returns the result instead of printing it
product = multiply(4, 6) # Save the result in a variable
print("The product is:", product)
```

Result: The product is: 24



The Difference Between print and return: -

print	return
displays the result on the screen only.	returns the result to use it later in the code

Notes:

Functions make your programs faster and easier to modify

3

School book exercise

First: Choose the correct answer from the following choices:

1. The for loop is used when:

- Repetition depends on a condition.
- The number of repetitions is unknown.
- We want to run the code only once.
- The number of repetitions is known.

2. A function in programming means:

- Repeating the code.
- A tool to perform a specific task.
- Storing data.
- Creating new variables.

3. The code inside the function must be:

- a) Without indentation.
- b) Written after a semicolon.
- c) Written with indentation (Indentation).
- d) Inside parentheses.

4. The keyword def is used for:

- a) Creating a variable.
- b) Creating a loop.
- c) Defining a function.
- d) Printing text.

5. The while loop continues to execute as long as:

- a) The number of repetitions is known.
- b) The condition is true.
- c) The number of repetitions = 0.
- d) The condition is false.

6. If we do not change the condition inside a while loop, it may cause:

- a) Immediate stop.
- b) System error.
- c) Infinite loop.
- d) Only one rotation.

7. The correct call to the function is by:

- a) Writing def only.
- b) Writing the function name followed by parentheses.
- c) Writing the variables inside print.
- d) Writing the file name.

8. Parameters in the function are:

- a) The values returned by the function.
- b) The values we pass to the function to work on them.
- c) The commands inside the function.
- d) The function name.

9. The difference between return and print is that return:

- a) Display the result on the screen.
- b) Store the result for later use.
- c) Repeats the code.
- d) Creates a new function.

10. The main purpose of functions is:

- Increasing the code length.
- Writing the same code several times.
- Making the program more organized.
- Eliminating the need for variable

Second : Put a check mark (✓) in front of the correct statement and an (X) in front of the incorrect statement:

- The for loop is suitable when you know the number of repetitions in advance. ()
- The while loop can work without a condition. ()
- Forgetting to change the condition inside a while loop may cause an infinite loop()
- The function does not work except when called. ()
- The function cannot contain parameters. ()
- The code inside the function must be indented. ()
- The return function is used to display the result on the screen only. ()
- Functions help organize the code and reduce repetition. ()
- The for loop always depends on a logical condition only. ()
- The function can be called more than once within the same program. ()



Data Structures or Collections

Identify data structures

They are ways to store data in a program in an organized way

Examples

- Shopping list (List): We write the items we want to buy.
- School timetable (Tuple): It is fixed and does not change during the week.
- Glossary (Dictionary): A data structure that stores data as pairs of keys and values.

(List)

A list is changeable. You can add or remove items.

- It uses square brackets [].

Unit 4 lesson 4



Examples

Example of Data Analysis:

Suppose we have students' grades in Mathematics, and we want to calculate the average:

```
grades = [85, 90, 78, 92, 88]          # List of grades
average = sum(grades) / len(grades)    # Sum of grades ÷ number of grades
print("The average is:", average)
```

Output: The average is: 86.6

Important Operations		
Operation	The code	Explanation
adding	grades. Append(95)	Add a new grade
Removing	grades. Remove(78)	Remove a grade
Sorting	grades.sort()	Sort grades

(Tuple)

- A tuple is not changeable (fixed).
- It uses round brackets ().

Data analysis example

suppose we have the days of the week and we cannot change

```
days = ("Saturday", "Sunday", "Monday", "Tuesday", "Wednesday", "Thursday", "Friday")
print("The third day is:", days[2])          # Counting starts from 0
```

Output: The third day is: **Monday**

When do we use a tuple?

When we need fixed data such as:

- Days of the week
- Location coordinates (latitude and longitude)

Dictionary

1. The dictionary is a collection of elements stored as a pair: value.
2. The dictionary is written between curly braces {} and separated by a colon:.
3. Used for quick access to data using the key instead of the index as in lists.
4. Keys must be unique and can be text or numbers.
5. We can add new items or change existing values easily.
6. It is often used to store organized data like students' or employees' data

Exercise (1):

```
student = {"name": "Ali", "age": 15, "grade": "A"}
print(student["name"])      # Print student name
student["age"] = 16         # Change age
student["city"] = "Cairo"   # Add new key
print(student)
```

Practical Exercises:

Looping Through the List

Exercise 1:-

You have a list of students' ages, write a program to count the number of

```
ages = [14, 16, 15, 17, 14, 16]      # List containing students' ages
count = 0                            # Variable starting from zero to count students older than 15
for age in ages:                     # Loop through each age in the list
    if age > 15:                      # Condition: Is the current age greater than 15?
        count += 1                  # If the condition is true, increase the counter by 1
print("The number of students older than 15 is:", count)
                                     # Print the number of students older than 15
```

Exercise 2:-

Loop through a list of names:

```
names = ["Mohamed", "Mona", "Haba", "Asmaa"]      # List of names
for name in names:                                # Iterate over each name in the list
    print(name)                                    # Print each
```



4

School book exercise

Questions and Exercises First: Choose the correct answer from the following choices:

1. What is meant by Data Structures?

- Ways to beautify the program's appearance.
- Ways to implement loops only.
- Ways to store data in the program in an organized manner.
- Commands to print texts.

2. Lists are characterized by:

- a. Fixed and non-modifiable.
- b. Written with regular parentheses ().
- c. Modifiable to add and remove elements.
- d. Cannot store more than one data type.

3. Which of the following uses square brackets?

- a. Tuple
- b. Set
- c. Dictionary
- d. List

4. The append() method is used for:

- a. Removing an element from the list.
- b. Adding a new element to the list.
- c. Sorting elements.
- d. Changing the list type.

5. Tuples are characterized by:

- a. Modifiable.
- b. Elements change automatically.
- c. Non-modifiable (fixed).
- d. Written with curly braces {}.

6. We use Tuple when we want data that is:

- a. Constantly changing.
- b. Fixed and unchanging.
- c. Automatically deleted.
- d. Dependent on keys and values.

7. The Dictionary stores data as:

- a. List inside a list.
- b. Key-value
- c. Values only without keys.
- d. Unordered elements.

8. Which of the following is used to write the dictionary?

- a. []
- b. ()
- c. { }
- d. <>

9. One of the properties of dictionary keys is that they:

- a. Can be repeated.
- b. Must be unique.
- c. Cannot be texts.
- d. Must be numbers only.

10. The dictionary is useful for storing:

- a. Fixed data only.
- b. Organized data like student data.
- c. Unique numbers only.
- d. Unordered elements.

Second: Put a check mark (✓) in front of the correct statement and an (X) in front of the incorrect statement:

- 1. Lists can be changed after creation. ()
- 2. Tuple elements can be changed. ()
- 3. Dictionary uses keys to access values. ()

4. Dictionary keys can be repeated. ()
5. List uses square brackets []. ()
6. Tuple uses curly brackets { }. ()
7. Dictionary is suitable for students' data. ()
8. List can store only one data type. ()
9. Tuple is suitable for fixed data like days of the week. ()
10. We cannot add new items to a dictionary. ()



Introduction to Encryption Using Python

Unit 4 Lesson 5



What is Cryptography?

It is the art of converting information from its original clear and understandable form called "**Plaintext**" into another unreadable form called "**Ciphertext**" that no one can read except the person who has the key to decrypting it. Think of it as a secret box with a lock and key!



1 Correct and Incorrect Uses of Cryptography:

Type of Use	Examples	Explanation
Correct use (Security)	Protecting messages (WhatsApp), securing passwords, secure websites (https://)	Used to protect your messages and data from hackers
Incorrect use (Harmful)	Ransomware viruses	Used to harm people by encrypting their files and asking for money

2 Types of Cryptography

Type	Explanation (Basic Idea)	Example
Simple encryption	Uses fixed and simple rules like shifting letters by a number (this is what we will learn)	Caesar Cipher
Complex encryption	Uses complex math equations and very long keys	AES (used by banks and companies)

Python's tools for cryptography

1 Function ord()

Function	Example
converts a letter to its secret number using Unicode	Ord (A) 65

② Function chr ()

Function	Example
Converts a number back to its letter	Ord (65) A

Simple Examples:

Example 1

1. Find the code of a letter 'S':

```
print(ord('S'))
# Output: 83
```

Example: 2

2. Find the letter of a code

```
print(chr(72))
# Output: H
```

Example :3

3. Try shifting a letter 'D'(+1):

```
1 code_D = ord('D')
2 shifted_code = code_D + 1
3 print(chr(shifted_code))
4 # Output: E
```

Explanation:

1. Using the ord() function, it converts the letter 'D' to its number in the UNICODE table and stores it in the variable code_D.
2. It increases the resulting number by 1 to get the number of the next letter in the order.
3. It converts the new number to a letter using the chr() function and prints it on the screen.
4. The final output is the letter E.

Note:

The letters used are capital letters.

Encryption and Decryption in Python

We will use the shift method (Caesar Cipher) which relies on:

• Encryption:

Original letter code + encryption key = encrypted letter code



• Decryption:

Encrypted letter code – encryption key = original letter code



5 School book exercises

First: Choose the correct answer from the following choices:

1. What is meant by Plaintext?

- a. The encrypted text.
- b. The unreadable text.
- c. The original clear text.
- d. The text protected by a key.

2. Ciphertext is:

- a. The original text.
- b. The text understandable by everyone.
- c. The text after transformation to become incomprehensible.
- d. The text that does not contain a key.

3. Which of the following is considered a correct use of encryption?

- a. Spreading viruses.
- b. Demanding ransom.
- c. Protecting messages and passwords.
- d. Deleting data.

4. Which of the following is an incorrect use of encryption?

- a. Securing accounts.
- b. Encrypting data for protection.
- c. Securing websites.
- d. Ransomware viruses.

5. Simple encryption relies on:

- a. Complex equations.
- b. Very long keys.
- c. Fixed rules like shifting.
- d. Artificial intelligence.

6. Which of the following types is used in banks and companies to ensure maximum security?

- a. Simple encryptions.
- b. Complex encryption.
- c. Manual encryption.
- d. Shift encryption.

7. The ord() function is used for:

- a. Converting text to a sentence.
- b. Converting number to letter.
- c. Converting letter to its number in Unicode.
- d. Decryption only.

8. The chr() function's function is:

- a. Deleting letters.
- b. Converting letter to number.
- c. Converting number to letter.
- d. Encrypting texts.

9. Shift encryption relies on:

- Subtracting a random number.
- Swapping words.
- Adding a fixed value to the letter's number.
- Changing sentence order

10. Shift decryption is done through:

- Adding the encryption key.
- Deleting the first letter.
- Subtracting the key from the encrypted letter's number.
- Automatically swapping letters.

Second: Put a check mark (✓) in front of the correct statement and an (X) in front of the incorrect statement:

- Encryption is a way to protect information from unauthorized access. ()
- Anyone can easily read the encrypted text without the encryption key. ()
- Incorrect use of encryption includes encrypting files and demanding money to decrypt them. ()
- Simple encryption like Caesar cipher is still used in protecting major banks. ()
- The ord() function converts the letter to a number. ()
- The chr() function converts the number to the corresponding letter. ()
- Complex encryption relies on long keys and mathematical equations. ()
- In shift encryption, a fixed value is subtracted to produce the encrypted text()
- Shift decryption is done using the subtraction operation. ()
- Encryption is not used in daily applications like WhatsApp or banks. ()

Encryption in Python: How to turn messages into secrets using the XOR operator?

(Bitwise Operations)

Imagine your computer is a large box of small lamps, each lamp is either :

on (representing 1) or off (representing 0).

This is the bit, the smallest unit of



how does the computer talk?

- it does not speak in complicated words or numbers
- it speaks the language of lights: which is (0, 1)

(Bitwise Operations)

- The LEDs represent words and numbers
- they are the basic components of storage.

Bit-level operations = grammar rules

- These are the rules that govern how the LEDs are handled.
- Mathematical and logical operations are performed directly on the LEDs (i.e., on the zeros and ones).

The function of these operations is to:

- Read the state of the LEDs
- Change the state of the LEDs very quickly
- Make decisions
- Perform complex calculations

What are bitwise operations?

They are a way to process numbers based on their internal representation consisting of zeros and ones

Their function and uses:

- **Processing speed:** It is the fastest way to perform many arithmetic and logical operations.
- **Encryption:** And this is our exciting use today! As it is the basis for building encryption algorithms

The Secret Star: XOR (Exclusive OR) Operation:

read as "ex or" or logical exclusion, and symbolized by ^ in Python.

XOR Rule of Operation:

- Imagine you are studying the state of two bits.

The possible result is:

- the lamp is **on (1)** if the states of the two bits are different (**one on and the other off**),
- the lamp is **off (0)** if the states of the two bits are similar (**both on or both off**),



0,1

Using XOR in Encryption: "The Secret of the Reversible

- If you combine the message with the secret key using the XOR operator,
- you get the encrypted message.
- If you take the encrypted message and combine it with the same secret key using the XOR operator again, you will get the original message!

3. Encryption and Decryption in Python

In Python, we can deal with texts, where we need to convert each letter in it to a number so that we can apply the XOR operator on it.

Helper Tools:

ord()(letter): Converts the letter to the number corresponding to this letter in the "Unicode" table.

chr()(number): Converts the number to the corresponding letter in the "Unicode" table.

The fixed secret key: We will use the key 10 in all examples.

(Encryption Process)**Encrypting a Single Letter (A)**

Explanation: The letter "A" is encrypted directly without a loop, where it is converted to a number, the XOR operation is applied with key 10, then converted to an encrypted letter through the following code in Python:

```
1-secret_key = 10
2-original char = "A"
3-encrypted_char_num = ord(original_char) ^ secret_key
4-cipher_text = chr(encrypted_char_num)
5-print(f"Cipher: {cipher_text}")
```

Explanation:

1. The variable **secret_key** represents the encryption key, and its value here is 10 and is used in the encryption process.
2. The variable **original_char** contains the original letter to be encrypted, which is "A".
3. The letter 'A' is converted to its number in the **Unicode** table using **ord()**, then the **XOR operation (^)** is performed on it with the key **secret_key** to encrypt it.
4. The numerical result from the **XOR** operation is converted to an encrypted letter using the **chr()** function.
5. The final encrypted letter is displayed on the screen using text formatting (f-string).

Decryption code for the previous code:

```
1-secret_key = 10
2- cipher_text = "K"
3-encrypted_char_num = ord(cipher_text)
4-original_char_num= encrypted_char_num^ secret_key
5-decrypted_char = chr(original_char_num)
6-print (f "Decrypted: {decrypted_char}")
```


6 School book exercises

First: Choose the correct answer from the following choices:

1. The bit is:

- a. The largest unit of measurement in data.
- b. A complex electrical circuit.
- c. The smallest storage unit representing 0 or 1.
- d. A decimal number.

2. Bitwise operations are used because they are:

- a. Very slow.
- b. Complex and cannot be executed by the computer.
- c. The fastest way to process data.
- d. No relation to encryption.

3. XOR operation works such that the result is 1 when:

- a. The two values are similar.
- b. The two values are different.
- c. The two values are zero only.
- d. The two values are one only.

4. One of the features of XOR that makes it suitable for encryption is:

- a. That it completely changes the shape of the data.
- b. That it is an irreversible operation.
- c. That it is a reversible operation that can be used for encryption and decryption.
- d. That it works only on texts.

5. Bitwise operations are:

- a. Operations performed directly on words.
- b. Operations performed only on images.
- c. Operations performed on zeros and ones inside the computer.
- d. Slow and complex operations.

6. The ord() function in Python is:

- a. Converting text to random numbers.
- b. Converting text to a list.
- c. Converting the letter to its number in Unicode.
- d. Converting the number to a letter.

7. XOR operation in Python is implemented using the symbol:

- a. +
- b. *
- c. &
- d. ^

8. The reversible property of XOR means:

- a. That the operation is performed only once.
- b. That XOR cannot be used for decryption.
- c. That performing it twice with the same key restores the original value.
- d. That the operation always changes the data.

9. The secret key used in encryption must:

- a. Change in each step.
- b. Be the same in both encryption and decryption operations.
- c. Not be used in decryption.
- d. Be a letter only.

10. Bitwise operations are important because they are:

- a. Work only on words.
- b. A fundamental part of the computer's implementation of decisions and operations.
- c. Not used in modern applications.
- d. Limited to games only.

Second: Put a check mark (✓) in front of the correct statement and an (X) in front of the incorrect statement:

1. The bit is the smallest storage unit in the computer. ()
2. XOR operation gives the result 1 only when the two values are equal. ()
3. XOR operator can be used in encryption because it has a reversible property. ()
4. Bitwise operations are slow compared to regular arithmetic operations. ()
5. The chr() function in Python converts the number to the corresponding letter in the Unicode table. ()
6. One of the properties of XOR is that it is not suitable for encryption because it cannot be reversed. ()
7. The computer internally deals with data in the form of 0 and 1. ()
8. The secret key should not be the same when decrypting. ()
9. Bitwise operations are the basis for encryption and pattern detection inside the computer. ()
10. XOR operation is used only in texts and does not work on numbers. ()



Answers, s keys to the questions in Unit 4

Lesson 1

Choose				True or false			
1	Data analysis and reading Excel. file	6	Calculate the average grade for each subject	1	√	6	X
2	.matplotlib	7	Find the highest grade	2	X	7	√
3	.pd.read_excel()	8	Calculate the number of students above 13.	3	√	8	X
4	.Displays the first 5 rows	9	alculate the correlation between subjects.	4	X	9	√
5	Drawing columns.	10	plt.show ()	5	√	10	X

Lesson 2

Choose				True or false			
1	Execute a specific code when a condition is met	6	Additional branch between if and else	1	√	6	√
2	if condition	7	.if...elif...else	2	X	7	X
3	.pd.read_excel()	8	The remaining conditions are ignored.	3	√	8	X
4	.We want to implement alternative code when the condition is not met	9	.if x == 5	4	X	9	√
5	.if x > 10: print("OK") else	10	"You are allowed" will be printed	5	√	10	√

Lesson 3

Choose				True or false			
1	The number of iterations is known	6	Infinite loop	1	√	6	√
2	A tool to perform a specific task.	7	.Write the function name followed by parentheses	2	X	7	X
3	Written with an indent. (Indentation).	8	The values passed to the function to operate on	3	√	8	√
4	Function definition	9	Stores the result for later use	4	√	9	X
5	Condition is true.	10	Makes the program more organized	5	X	10	√

Lesson 4

Choose				True or false			
1	Methods for storing data in the program in an organized manner	6	Constant and unchanging	1	√	6	X
2	Items can be added and deleted	7	Key Value	2	X	7	√
3	List	8	}	3	√	8	X
4	Add a new item to the list.	9	It must be unique	4	X	9	√
5	Non-adjustable (fixed).	10	Structured data such as student data	5	√	10	X

Lesson 5

Choose				True or false			
1	Clear original text	6	Complex Encryption	1	✓	6	✓
2	Text after being transformed into unintelligible text	7	Converting a character to its Unicode number	2	X	7	✓
3	Protection of messages and passwords	8	Converting a number to a character	3	✓	8	X
4	Ransomware	9	Adding a constant value to the character number	4	X	9	✓
5	Fixed rules such as offset	10	Subtracting the key from the encrypted character number	5	✓	10	X

Lesson 6

Choose				True or false			
1	The smallest unit of storage, representing 0 or 1	6	Converting a character to its corresponding number in Unicode	1	✓	6	X
2	The fastest way to process data.	7	Λ	2	X	7	✓
3	The two values are different.	8	Performing XOR twice with the same key returns the original value.	3	✓	8	X
4	It is a reverse operation that can be used for encryption and decryption	9	The key must be the same in both encryption and decryption.	4	X	9	✓
5	Operations performed on zeros and ones within a computer	10	This is a fundamental part of how computers execute decisions and processes	5	✓	10	X

1. What is the best description of artificial intelligence?

- A. Making machines faster and stronger.
- B. Making machines think and learn like humans.
- C. Making machines bigger.
- D. Making machines smaller.

2. Which scientist created a famous test to determine if a machine is intelligent?

- A. Isaac Newton
- B. Albert Einstein
- C. Alan Turing
- D. Al-Khwarizmi

3. Why is learning artificial intelligence important for your future?

- A. Because it will soon disappear.
- B. Because it will become an essential part of our jobs and daily lives.
- C. Because it is a difficult and complex subject only for customers.
- D. Because it is an entertainment tool.

4. A computer learning to play chess and beat the best players is an early example of:

- A. Machine learning
- B. The internet
- C. 3D printing
- D. Using office software

5. How can artificial intelligence help solve the problem of traffic congestion?

- A. By manufacturing more cars
- B. By analyzing data and organizing traffic flow
- C. By removing traffic lights,
- d) By disabling car movement.

6. The statement "Artificial intelligence is a powerful tool" means that:

- a) we should fear and avoid it
- b) we should understand its impact and direct it to serve humanity
- c) no one can control it
- d) its irresponsible use

